Mathematics Framework

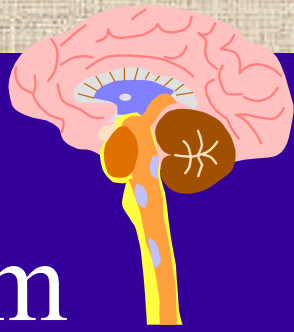
For California Public Schools

Kindergarten through Grade Twelve

Presented by:

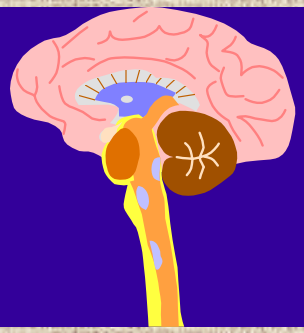
Curriculum Frameworks Office

Mental Math-Head Problem



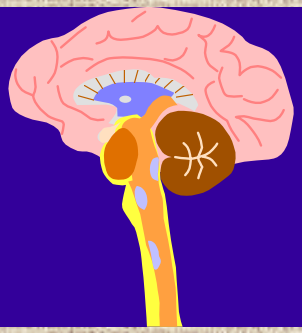
Take the number 7; triple it; add -2; double that; take the sum of the digits; find that number on a clock and go diametrically opposite it; show me on your fingers the answer.

Brain Research



Evidence is accumulating that the brain works a lot like a muscle -- the harder you use it, the more it grows. Although scientists had long believed the brain's circuitry was hard-wired by adolescence and inflexible in adulthood, its newly discovered ability to change and adapt is apparently with us well into old age.

Brain Research



- Best of all, this research has opened up an exciting world of possibilities for treating strokes and head injuries… and warding off Alzheimer's disease.

Don Golden, *Life*, July 1994, *Building a Better Brain*

I. General Overview

- Introduction
- Framework Themes
- Organization by Chapter Contents
- A Balanced Mathematics Program
- STAR Testing & Assessment
- Staff Development & Other Resources

Goals Framework Rollout

- General Overview of CA Mathematics Framework
- Dissemination of Document

Activity I-Survey

Please take 10 minutes to answer the questions on the Effective Mathematics Program Survey from your district's perspective.

Activity Exercise (pdf)

Introduction

- Primary Audiences:
  - educators
  - developers of instructional resources
- Purpose of the Framework
- Themes

Purpose of the Framework

- To guide curriculum development and instruction so that *all* students meet or exceed the Mathematics Content Standards.
- To provide a context for implementing the Standards.
- To address how the Standards can best be met for *all* students, including English language learners, special education, at-risk and accelerated learners.

Mathematical Reasoning

At the heart of mathematics is reasoning. One cannot do mathematics without reasoning. Sense making and reasoning usually go hand in hand since it is through the application of deductive, inductive, spatial, or algebraic reasoning that individuals are able to discern truths. Teachers need to provide their students with many opportunities to reason through their solutions, conjectures, and thinking processes. Opportunities in which very young students use the language of logic, make distinctions between irrelevant and relevant information or attributes, and justify relationships between sets can contribute to their ability to reason logically.

(The Partnership in Change Handbook, Boston University, 1997)

Framework Themes

- Builds on the Mathematics **Standards**.
- Emphasizes the importance of a **balanced** mathematics curriculum.
- Highlights the importance of **mathematical reasoning**.

More Framework Themes

- Stresses the importance of **frequently assessing** toward achieving the Standards.
- Favors guidelines on **effective instruction** derived from reliable **research**.
- Addresses the needs of **all learners**.

Framework Organization

- Ch. 1 Guiding Principles and Key Components of an Effective Math Program
- Ch. 2 Content Standards with sample problems
- Ch. 3 Grade Level Considerations
  - K-7 by grade
  - 8-12 by discipline

FW Organization - cont.

- Ch. 4 Instructional Strategies
- Ch. 5 Assessment
- Ch. 6 Universal Access
- Ch. 7 Responsibilities of Teachers, Students, Parents, Administrators
- Ch. 8 Professional Development

FW Organization - cont.

- Ch. 9 Use of Technology
- Ch. 10 Criteria for Evaluating Instructional Resources
- Appendices
- Glossary
- References

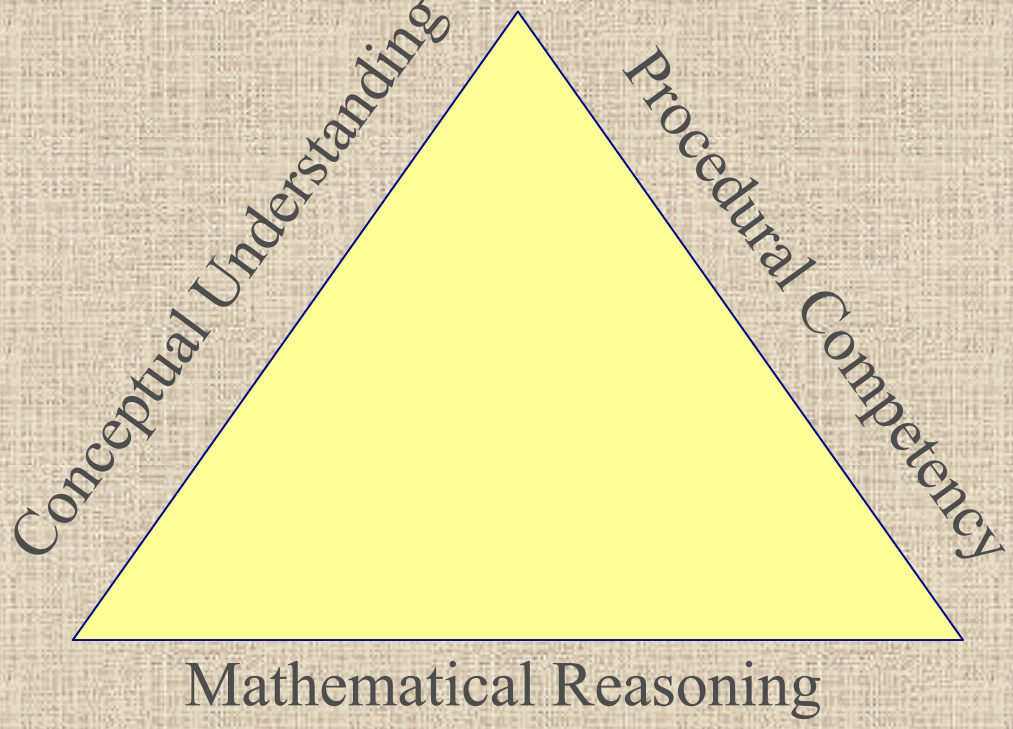
Critical Tool

In short, the Framework should be viewed as a critical tool for designing and implementing an effective mathematics program in kindergarten through grade 12 and evaluating instructional resources.

II. Guiding Principles

- Achieving a Balanced Mathematics Program
- Teacher Goals
- Student Goals
- Key Components of an Effective Mathematics Program (survey)

Achieving a Balanced Math Program



Balance

A long-standing content issue in mathematics concerns the balance between theoretical and applied approaches. Mathematics is both. In the theoretical (pure) sense, mathematics is a subject in its own right with distinct methods and content to be studied.

(Holz, Alan, Walking the Tightrope 1996, p.5)

Balance

But mathematics is also extremely applicable both in the practical sense and in connection to other realms of study including the arts, humanities, social sciences, and the sciences. Much of what is regarded as the beauty of mathematics is found in its theoretical aspects while much of what we think of as the power of mathematics is found in its applied aspects.

Balance

Any comprehensive representation of the content of mathematics must balance these aspects of beauty and power

(Holz, Alan, Walking the Tightrope 1996, p. 5)

Three Areas Needed for Balance

- **Procedural Competency** - those skills that students use routinely and automatically.
- **Conceptual Understanding** - knowing how to apply skills as well as when and why.
- **Problem Solving** - involves applying skills, understandings and experiences to resolve new or perplexing situations.

Activity II

Discuss with your neighbor how to conceptually explain the mathematical ideas in doing the problem:

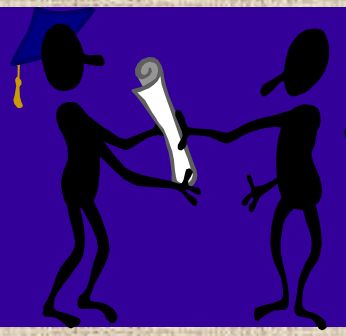
$$\frac{3}{8} \div \frac{1}{4}$$

Activity Exercise

Major Goals of Mathematics Education

How can your district assist teachers in connecting the standards with the three components of balance?

Goals for Teachers



- To increase teachers' **knowledge of mathematics**.
- To provide an instructional program that preserves **balance**.
- To **assess** toward the achievement of the Mathematics Standards.

Goals for Teachers

- To provide the **learning** in each instructional year for **success**.
- To create a classroom environment that fosters a **genuine understanding and confidence in all students** to achieve the Standards.

Goals for Teachers

- To offer all students a **challenging** learning experience to exceed the Standards.
- To offer **alternative** instructional suggestions and **strategies**.
- To identify approaches that are most **successful and efficient**.

Goals for Students

- To develop fluency in **procedural skills, conceptual understanding, and mathematical reasoning**.
- To **communicate** precisely.
- To develop **logical** thinking.

Goals for Students

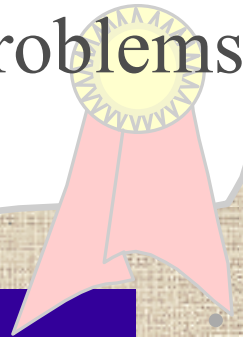
- To make **connections** among mathematical ideas.
- To **apply mathematics** to everyday life.
- To develop an appreciation for the **beauty and power** of mathematics.

Content Standards in Context

- Content Standards
- Mathematical Strands
- Key Standards (Grades K-7)
- Highlighted Standards (Grades 8-12)
- Grade Level Considerations
- Grade Level Accomplishments

Mathematics Content Standards

- 1997 - State Board of Education adopted standards based on recommendations from the Academic Standards Commission.
- 1999 - Mathematics Framework was published with the Content Standards and sample problems to exemplify standards.



Strands

- Number Sense
- Algebra & Functions
- Measurement & Geometry
- Statistics, Data Analysis & Probability
- Mathematical Reasoning

Mathematical Reasoning

This strand, which is inherently embedded in each of the other strands, is fundamental in developing the basic skills and conceptual understanding for a solid mathematical foundation. It is important when looking at the Standards to see the reasoning in all of them. (p. 107)